

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Previously Presented) A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

wherein each cavity has a substantially constant diameter along a region extending between its lower opening and its upper ceiling region, such that lines extending longitudinally along confronting inner surfaces of each sidewall are substantially parallel to one another; and

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein.

2. (Previously Presented) The system of claim 1, wherein at least a lower portion of said sidewall of each projection comprises a resiliently flexible material, such that said flexible lower portion of said sidewall can bend while maintaining the shape of said cavity so that said lower opening can bend to face said beads in said bead supply.

3. Canceled.

4. (Original) The system of claim 1, wherein the diameter of said lower opening is between about 100-1,250 micrometers and the longitudinal length of said sidewall, from said lower opening and to said upper ceiling, is between about 0.50-1.25 times the diameter of said lower opening.

5. **(Original)** The system of claim 1, wherein the diameter of said lower opening is between about 250-750 micrometers and the longitudinal length of said sidewall, from said lower opening and to said upper ceiling, is between about 0.75-1.10 times the diameter of said lower opening.
6. **(Original)** The system of claim 1, wherein said cavity is dimensioned to receive at least half of one submillimeter bead, and to preclude entry therein of a substantial portion of a second such bead.
7. **Canceled.**
8. **(Previously Presented)** A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:
a plurality of projections depending from a support at spaced-apart locations defining an array;
a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;
wherein said upper ceiling region defines a surface extending inwardly from said sidewall;
an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein;
a plurality of ampules for containing said bead supply, said ampules disposed in an array alignable with said projection array; and
a plurality of covers, each cover configured to extend over an upper opening of one of said ampules.
9. **(Original)** The system of claim 8, wherein each of said covers is a frangible membrane.
10. **(Previously Presented)** The system of claim 8, wherein said support is held by a frame that is

(i) adapted to pivot about a generally vertical axis, rendering movable said projection array along a generally arcuate or circular pathway, and
(ii) adapted for reciprocal linear motion along a generally vertical pathway;
such movement permitting said projections to be aligned with said ampule array and lowered so that each projection can enter a respective one of said ampules.

11. (Previously Presented) The system of claim 8, wherein one of said ampules holds a plurality of submillimeter beads that carry a first set of analyte-specific reagents, and another of said ampules holds a plurality of submillimeter beads that carry a second set of analyte-specific reagents; said first and second reagent sets differing from each other by at least one analyte-specific component.

12. (Original) The system of claim 2, wherein said resiliently flexible sidewall has a generally cylindrical shape, with both an inner diameter and a longitudinal depth of between about 100-1,250 micrometers.

13. (Original) The system of claim 12, wherein said inner diameter and longitudinal depth are between about 350-425 micrometers.

14. (Original) The system of claim 1, wherein said cavity is formed by a resiliently flexible, tubular sleeve fit over the end of a respective projection, said sleeve having an overhang region extending below a terminal end of said projection defining said sidewall; and wherein said terminal end of said projection, facing said cavity, defines said upper ceiling region of said cavity.

15. Canceled.

16. (Currently Amended) A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:
a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall; and

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein;

wherein each of said projections is a capillary tube having an axial lumen extending therethrough, each lumen having (i) a first end that opens into a respective one of said cavities through said ceiling region, and (ii) a second end disposed in fluid communication with a pressure-control assembly;

wherein said pressure-control assembly includes (i) a vacuum pump operable to establish a reduced pressure within each of said lumens, said reduced pressure defining said attraction source; and (ii) a pump operable to establish an increased pressure within each of said lumens, said increased pressure effective to displace any beads retained in said cavities.

17. (Previously Presented) The system of claim 16, wherein each of said lumens has an inner diameter at said first end that is smaller than the diameter of a respective cavity at a location directly adjacent said ceiling region.

18. (Original) The system of claim 17, wherein each of said cavities has an inner diameter at a location directly adjacent said ceiling region of greater than 275 micrometers, and each of said lumens has an inner diameter at said first end of between 100-275 micrometers.

19. Canceled.

20. (Currently Amended) A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein; and

a detection system having a field of view extending along each of said projection end regions, and adapted to sense the presence ~~of~~ or absence of a bead retained in said cavities;

wherein said detection system includes a plurality of elongated light-conductive fibers, each fiber having one end that extends along one of said projections and faces said cavity, and a second end disposed in optical communication with a camera device.

21. **Canceled.**

22. **(Previously Presented)** A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein; and

a conduit assembly having a plurality of conduits for separately channeling a plurality of submillimeter beads released from said cavities to desired locations on a substrate, said conduits having (i) first openings at their upper ends disposed in an array having a center-to-center pitch like that of the projection array such that the first openings are substantially alignable under the projections, and (ii) second openings at their lower ends disposed in an

array having a center-to-center pitch like that of the substrate array such that the second openings are substantially aligned thereover;

wherein said second openings are disposed in an array having a center-to-center pitch substantially smaller than that of the first-opening array.

23. (Previously Presented) The system of claim 22, wherein the center-to-center pitch of the second-opening array is reduced by a factor of at least about 3, as compared to that of the first-opening array.

24. (Previously Presented) The system of claim 22, further comprising a substrate, wherein said substrate is a micro-card having a plurality of wells disposed in an array alignable under said second-opening array.

25. (Original) The system of claim 24, further comprising
a detection system having a field of view extending into each of said conduits, and adapted to sense the presence or absence of a bead in each well of said microcard.

26 – 47. Cancelled.

48. (Currently Amended) A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein; and

a detection system having a field of view extending along each of said projection end regions, and adapted to sense the presence ~~of~~ or absence of a bead retained in said cavities;

wherein said detection system includes at least one image capture device positioned to capture and display an image that includes the lower end region of each of said projections to provide an indication of the presence or absence of a bead retained in the lower end region cavity of each projection.

49. (Original) The system of claim 48, wherein said detection system includes a pair of image capture devices.

50. (Original) The system of claim 48, wherein the captured and displayed image further provides an indication of whether more than one bead is retained in the lower end region cavity of any projection.

51. (Previously Presented) A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein; and

a conduit assembly having a plurality of conduits for separately channeling a plurality of submillimeter beads released from said cavities to desired locations on a substrate, said conduits having (i) first openings at their upper ends disposed in an array having a center-to-center pitch like that of the projection array such that the first openings are substantially alignable under the projections, and (ii) second openings at their lower ends disposed in an

array having a center-to-center pitch like that of the substrate array such that the second openings are substantially aligned thereover;

wherein each of said conduits is curved along a longitudinal direction from said first opening to said second opening.

52. (Previously Presented) A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein;

a conduit assembly having a plurality of conduits for separately channeling a plurality of submillimeter beads released from said cavities to desired locations on a substrate, said conduits having (i) first openings at their upper ends disposed in an array having a center-to-center pitch like that of the projection array such that the first openings are substantially alignable under the projections, and (ii) second openings at their lower ends disposed in an array having a center-to-center pitch like that of the substrate array such that the second openings are substantially aligned thereover; and

a parallelogram linkage assembly supporting said conduit assembly for reciprocal arcuate movement between a raised position and a lowered position.

53. (Previously Presented) The system of claim 52, further comprising:

(i) a carousel adapted for rotation about a central axis, said carousel (a) pivotally supporting said parallelogram linkage assembly for movement radially about a central axis of rotation of the carousel, and (b) having a substrate holding area adjacent to said parallelogram linkage assembly; and

(ii) a stationary rail extending along an inner region of said carousel and having a continuous bearing surface in mechanical communication with said parallelogram linkage assembly, said bearing surface having (a) a region disposed a first distance from central axis and at a first vertical height, whereat said conduit array assumes said lowered position over said substrate holding area, and (b) a region disposed a second distance from said central axis, shorter than said first distance, and at a second vertical height, higher than said vertical height, whereat said conduit array assumes said raised position.

54. (Previously Presented) A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein; and

a conduit assembly having a plurality of conduits for separately channeling a plurality of submillimeter beads released from said cavities to desired locations on a substrate, said conduits having (i) first openings at their upper ends disposed in an array having a center-to-center pitch like that of the projection array such that the first openings are substantially alignable under the projections, and (ii) second openings at their lower ends disposed in an array having a center-to-center pitch like that of the substrate array such that the second openings are substantially aligned thereover; and

a substrate, wherein said substrate is provided with a pair of spaced-apart indexing holes, each being aligned with a respective indexing pin depending from a lower side of said conduit array; whereupon registering said indexing pins in said indexing holes substantially aligns said second-opening array with said well array of said substrate.

55. **Cancelled.**

56. **(Previously Presented)** A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

- a plurality of projections depending from a support at spaced-apart locations defining an array;

- a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

- wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

- an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein;

- a conduit assembly having a plurality of conduits for separately channeling a plurality of submillimeter beads released from said cavities to desired locations on a substrate, said conduits having (i) first openings at their upper ends disposed in an array having a center-to-center pitch like that of the projection array such that the first openings are substantially alignable under the projections, and (ii) second openings at their lower ends disposed in an array having a center-to-center pitch like that of the substrate array such that the second openings are substantially aligned thereover;

- a detection system having a field of view extending into each of said conduits, and adapted to sense the presence or absence of a bead on said substrate under each of said second openings;

- wherein said detection system further comprises:

- a radiation source adapted to illuminate said substrate at locations below each of said second openings; and

- a plurality of elongated light-conductive fibers, each fiber having (i) one end disposed to receive light traveling up through a respective conduit, and (ii) a second end that communicates with a camera device.

57. **(Previously Presented)** A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein;

a conduit assembly having a plurality of conduits for separately channeling a plurality of submillimeter beads released from said cavities to desired locations on a substrate, said conduits having (i) first openings at their upper ends disposed in an array having a center-to-center pitch like that of the projection array such that the first openings are substantially alignable under the projections, and (ii) second openings at their lower ends disposed in an array having a center-to-center pitch like that of the substrate array such that the second openings are substantially aligned thereover; and

a support structure, wherein said first openings are disposed in an array along one side of said support structure, and said second openings are disposed in an array along an opposite side of said support structure, wherein said first-opening array is arranged with a center-to-center pitch larger than that of said second-opening array, and wherein a region of each conduit extending from a respective one of said second openings is of capillary size, such that a liquid placed in contact with said second-opening array can be drawn at least partially into said conduits by way of capillary action.

58. (Original) The system of claim 57, wherein said capillary-size region of each conduit has an inner diameter of less than about 1mm.

59. (Original) The system of claim 57, wherein capillary-size region of each conduit has inner sidewalls that are hydrophilic.

60. (Previously Presented) A system for picking up a plurality of submillimeter beads from a bead supply and transferring said beads to a desired location, comprising:

a plurality of projections depending from a support at spaced-apart locations defining an array;

a cavity formed at a lower end region of each of said projections, each of said cavities defined by (i) a lower opening, (ii) an upper ceiling region, and (iii) a sidewall extending between said lower opening and said upper ceiling region;

wherein said upper ceiling region defines a surface extending inwardly from said sidewall;

an attraction source, operable at said projection end regions, effective to draw beads from said supply into said cavities and to releasably retain said beads therein;

a covering system for covering said beads after said beads have been disposed at said desired locations on a substrate, wherein said desired locations comprise an array of wells formed in said substrate, said covering system comprising:

a continuous web of a cover material mounted for movement from a supply position to a take-up position; and

a shearing blade mounted for reciprocal linear motion along a direction substantially normal to said web for cutting a portion of said cover material at a region between said supply position and said take-up position.

61. (Original) The system of claim 60, wherein said cover system further comprises:

an idler reel for holding said cover material in said supply position;

a driven reel for taking up said cover material in said take-up position;

a movable piston for effecting said linear reciprocal motion, said movable piston having a lower face on which said movable blade is mounted; and

a resiliently compliant, substantially planar surface provided on said lower face along a region between said movable blade for pressing said cover material against an upper surface of said substrate.

62. (Original) The system of claim 60, wherein said cover material comprises an optically clear film.